



# Improving downstream water quality

## Aerating turbine technology

The need to improve water quality, specifically dissolved oxygen content, as water is discharged from hydroelectric equipment is an issue many hydropower producers face. For decades Voith Hydro has been an innovator and leader in providing aeration solutions that improve environmental compatibility through the increase of dissolved oxygen downstream of hydropower producers.

Aerating turbines enrich the water below the hydropower station with additional oxygen. This is a critical improvement to many dams in warmer climates. Distributed aeration turbine runners are partially hollow and fitted with specially designed runner blades. The latter admit air bubbles to the water. The entire process improves the water quality and has a positive effect on the fish populations and other aquatic life within the river system. Voith Hydro is the leading supplier of this auto-venting technology.

**The best natural aeration technology, distributed aeration runners at a glance:**

- Air is naturally drawn through the Voith patented aerating hollow runner blades
- Optimal bubble distribution in the draft tube and the tailrace
- Provides the maximum dissolved oxygen uptake
- Most efficient aeration solution available today

## TVA's Norris Dam, site of the first installed aerating turbines



## Aerating Francis turbine



### Auto-venting turbines

The water in the lower reaches of many reservoirs is oxygen deficient, and passing this low dissolved oxygen water through a hydro site can result in damage to the downstream ecosystem.

Often, low pressure regions in the turbine passages can be utilized to draw atmospheric air into the turbined flow during operation. These machines are referred to as auto-venting turbines. They generally consist of three different aeration options, including distributed, central and peripheral aeration.

The interaction between the incoming bubbles and the surrounding water drives the aeration performance by influencing the pressures at the air injection location, the resulting air flows, the dissolved oxygen uptake efficiency and the turbine performance. Distributed aeration turbine runners are particularly cost-effective for injecting large quantities of air into the discharge when incoming dissolved oxygen is low.

### Choosing the right approach

For each project, individual site characteristics, plant design, and desired operation are incorporated into in-house calculation methodologies which account for the necessary bubble modeling to optimize aeration behavior. Based on the predictions, Voith Hydro selects aeration solutions which provide the best value for the owner by maximizing uptake while minimizing the impact on the turbine performance and aeration costs.

Voith Hydro's distributed aeration turbine runner is a proven technology that has been continually improved since it was first introduced at the Tennessee Valley Authorities' (TVA) historic Norris Dam in 1995.

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